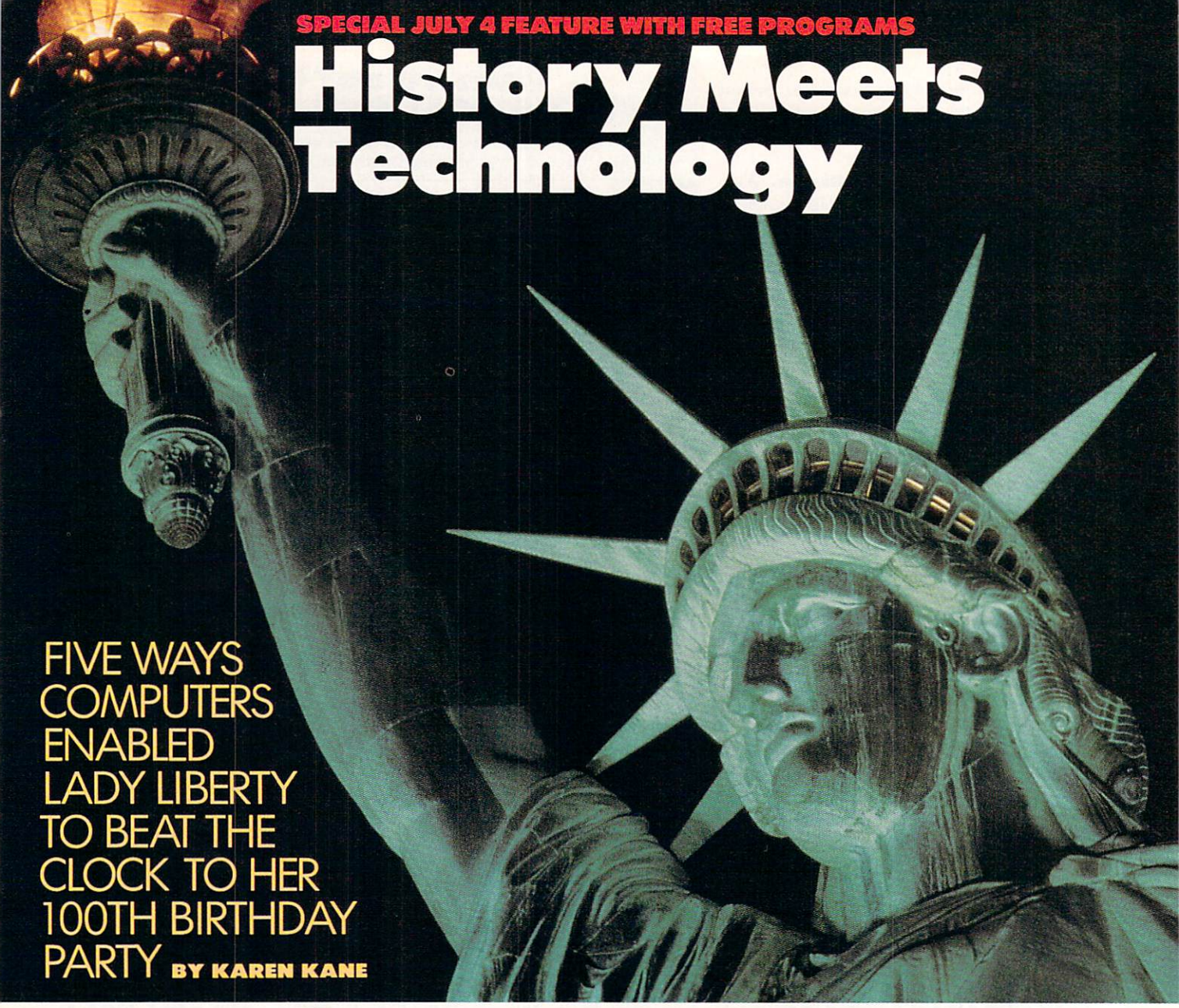
SPECIAL JULY 4 FEATURE WITH FREE PROGRAMS

History Meets Technology



FIVE WAYS COMPUTERS ENABLED LADY LIBERTY TO BEAT THE CLOCK TO HER 100TH BIRTHDAY PARTY

BY KAREN KANE

July Fourth: an immovable date for the Statue of Liberty's 100th anniversary celebrations. And thanks to the aid of computers, repairs on the weathered surface and weakened structure of the Statue of Liberty will be completed in time for this summer's festivities in New York City. Computers have played a vital role in pushing, prodding, and propelling the project forward, from the all-important fundraising, through design and project organization, to keeping special events on track during the opening-weekend crush. You can even use computers at an exhibit near the statue to view photographs of American families (perhaps your own!) and learn their histories. Organizers expect around 2 million people to visit the statue each year.

"God was with us," said Peter Zabriskie, Director of Planning and Systems for the Statue of Liberty-Ellis Island Foundation. Zabriskie, whose Ukrainian and Russian grandparents passed through Ellis Island in the early 1900's, closely monitored the schedules he created, along with other project planners, architects and engineers, on IBM PCs, as every inch of the national symbol that took 21 years to construct in the 19th century was restored, from base to torch, in just a fraction of that time.

COMPUTER-SLEUTHING STRESS POINTS

Computers played a central role from the project's beginning five years ago, when the French engineering firm CETIM began a detailed structural analysis of the statue's existing condition. To calculate the effects of wind on the aging structure, engineers placed an anemometer at the highest point on the torch to measure wind velocity, and installed stress gauges throughout the armature. These instruments were connected to a computer, creating an international on-line link between the statue and the firm's engineers in Boston and Paris.

This approach—using classical mechanical stress analysis in tandem with advanced computer applications—parallels the method used by Alexandre Gustave Eiffel, the designer of

PHOTOGRAPH BY NICK CERULLI 1986 SOL-EIF, INC.

KAREN KANE *is* FAMILY COMPUTING*'s researcher.*

the Eiffel Tower and Liberty's original support structure. Eiffel combined ancient metalwork techniques (*repoussé*) with the most advanced metal framework architecture of *his* time.

As Pierre Provoyeur, curator of the museums of France said when describing the method used by Eiffel: "It was a typically French solution, marrying the best of the past with the best of the present. The classical *repoussé* method, in existence since Roman times, was wed to the world's most advanced engineering technology."

When planning the next step, reconstruction of the badly damaged torch and flame, it was important that craftsmen remained faithful to the original design of the statue's sculptor, Auguste Bartholdi. Again computers were put to the task. Using sophisticated scanning devices, Liberty's analysts were able to generate three-dimensional, digitized drawings of the torch.

PLOTTING THE DESIGN

Next, coordinating architects Swanke Hayden Connell of New York entered the framework of the statue on their computer-aided design development (CADD) system, and generated a computer drawing by keying detailed measurements and dimensions into their Calcomp graphics system. According to Bradley Meade, associate principal architect for the firm: "Different elements of the structure were color-coded to render a clear computer representation of the statue's base, central pylon, structural planes, and connecting parts. This computerized drawing helped show the geometrical relationships among the elements of the statue and helped us build a detailed physical model."

PLANNING WITH PCS

To help juggle what had become a mind-boggling array of details, planners at the Statue of Liberty-Ellis Island Foundation sat down at their eight IBM PCs to break the project up into departments, including fundraising, restoration, and celebration. Following a divide-and-conquer principle, each of these departments were in turn divided up into manageable jobs and assigned schedules and budgets.

Having just four years to raise the $265 million needed for the restoration, the Statue of Liberty-Ellis Island Foundation went on-line with Dialog and Epsalom information services to search for potential donors. Over 3,000 names and addresses were compiled and entered into *RBASE 5000*, a database program from Microrim. A customized *RBASE* teamed with *Multimate*'s mailmerge feature, and a Canon laser printer helped produce thousands of letters, invitations, and tickets to fundraising events; mailing labels took shape on an Epson FX-100. "With the flexibility of computers, we could control the formats for mailings right from the office," said Zabriskie.

As donations came in, planners used spreadsheets like Lotus *1-2-3* to keep track of dollars and contributors from each of five geographic fundraising regions. One program, *CalcIT* (Martin Marietta), gave planners a useful three-dimensional capability that allowed them to set up a separate spreadsheet page for each region, then consolidate the pages for comprehensive totals. If one phase of construction went over budget, funds could be allocated to it from another phase with a surplus.

MONITORING THE PROGRESS

Another computer program became an invaluable tool by creating an overall planning model for the restoration work. With the *Primavera Project Planner* (Primavera Systems) and IBM PCs, each job (scaffolding assembly, skin repair and cleaning, sprinkler systems installation, etc.) was put on a time line divided into months from January 1984 to July 1986. Variables in the job schedules were then manipulated to determine, for example, whether double shifts should be set up to speed the completion of a phase, and how much the effort would cost.

A working schedule was established, daily progress was recorded, and adjustments were made when deadlines weren't met. "At one point," said Zabriskie, "fabrication and installation of the metal stairs was a bit behind schedule. *Primavera Project Planner* helped us reorganize the allocation of resources to pull this phase of the restoration out of its critical position."

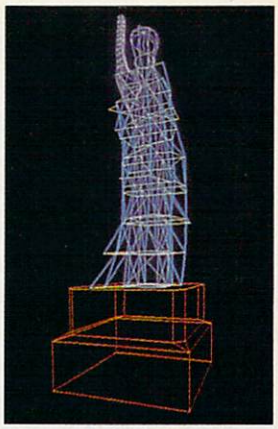
To keep close tabs on progress, the planning office used a program called *Remote* (Microstuf) and Hayes modems to communicate with computers at the restoration offices. At any time, they could read the latest developments entered on the hard disks at locations throughout the city. This strict monitoring, made simple with the help of computers, was crucial to ensure that the statue would be ready for the celebrations.

KEEPING TRACK OF THE FESTIVITIES

Even the "Liberty Weekend" celebrations will be monitored by personal computers. A new program, *The Finest Hour* (Primavera Systems) will detail every planned activity by the hour so that schedules can be quickly updated as necessary.

At one of the special exhibits, "America's Family Album," visitors will be able to search a database of family photographs stored on video discs and accessed by IBM PC XT's. The system will allow users to cross-check photo files by family name, country of origin, and year of arrival in the United States. This information will appear on a color monitor along with the photograph.

The Statue of Liberty's reconstruction was an enormous undertaking that required not only the skill of diligent craftsmen, but the kind of precision design, timing and organization that only advanced technology can offer.



PHOTOGRAPH COURTESY SWANKE HAYDEN CONNELL ARCHITECTS

COMPUTE YOUR ROOTS

If you're interested in researching your ancestry, here is a short list of genealogical software that will help you store and organize your family data. For more information on how to contribute photos and family background to the "America's Family Album" exhibit, contact your local photo dealer or write to "America's Family Album," P.O. Box 23195, Rochester, New York 14692.

Family Roots. For 64K Apple, C 64/128, IBM PC/PC*jr*, and Tandy Model IV, $185. (Quinsept, Inc., P.O. Box 216, Lexington, MA 02173; [617] 641-2930.)

Roots II. For IBM PC/PC*jr*, $195. (Commsoft, Inc., 2257 Old Middlefield Way, Mountain View, CA 94043; [415] 967-1900.)

The Genealogist's Right Hand. For 48K Apple, $50. (User Friendly Systems, Inc., 6135 Ross Rd., Fairfield, OH 45014; [513] 874-4550.)

PORTRAIT OF LIBERTY

BY JOHN JAINSCHIGG

In honor of the Glorious Fourth and the unveiling of the newly refurbished Statue of Liberty, here's *Portrait of Liberty*—a patriotic program you can type in that really gives your computer's sound and/or graphics capabilities a workout. Part 1 of *Portrait of Liberty* plays a stirring arrangement of the "Star Spangled Banner." Part two draws a detailed portrait of the statue on your computer's screen. Just follow the tips and instructions below and program up some real computer fireworks for our country's birthday!

INSTRUCTIONS

If you're an old hand at typing in BASIC programs, go right to the instructions, below. If you're a newcomer, welcome aboard! Read the tips *(opposite)* to make your first program-typing experience a rewarding one.

If you just want to hear "The Star Spangled Banner," type in the listing for your computer, omitting the lines printed in red.

If you want to see the Statue's portrait, too, type in the entire listing, including the lines printed in red, and add the data lines on page 50.

Apple II series/*Portrait of Liberty*

Note to Apple owners: The graphics data for Portrait of Liberty *is included in lines 1000-1420, below. Omit these lines, along with lines 10-70, if you just want to hear the "Star Spangled Banner."*

```
10 HOME:HGR2:HCOLOR= 3
20 READ A,B
30 FOR I = 1 TO 200
40 READ C,D:IF C = 0 THEN READ A,B:GOTO 70
50 HPLOT A*.7,B*.7 TO C*.7,D*.7
60 A = C:B = D
70 NEXT I
80 DIM V(102,2)
90 FOR I = 0 TO 28:READ A:POKE 768+I,A:NEXT I
100 FOR I = 1 TO 102:READ V(I,1),V(I,2):NEXT I
110 FOR I = 1 TO 102
120 POKE 6,V(I,2)*20:POKE 8,V(I,1)
130 CALL 768:NEXT I:GOTO 110
1000 DATA 116,172,138,205,151,244,194,253,210,249
1010 DATA 230,218,239,199,228,209,221,212,200,213
1020 DATA 186,207,173,193,165,169,165,155,174,155
1030 DATA 176,151,184,151,184,149,187,148,188,151
1040 DATA 191,151,191,149,194,149,199,155,199,164
1050 DATA 194,178,197,182,205,184,208,184,219,181
1060 DATA 216,178,212,178,210,179,206,178,203,179
1070 DATA 203,165,204,148,200,142,193,141,176,141
1080 DATA 168,144,166,140,175,132,184,130,204,118
1090 DATA 215,127,239,135,245,139,253,153,254,160
1100 DATA 260,166,263,166,264,168,263,170,260,170
1110 DATA 257,174,252,180,251,185,247,189,253,202
1120 DATA 247,236,253,235,253,250,262,255,300,255
1130 DATA 290,232,292,228,288,226,281,191,279,182
1140 DATA 268,158,273,153,263,134,263,120,266,113
1150 DATA 328,112,272,99,272,96,349,85,266,85
1160 DATA 255,78,313,25,233,67,215,64,204,21
1170 DATA 194,65,174,67,94,26,153,76,152,78
1180 DATA 142,85,59,85,136,96,136,99,78,113
1190 DATA 141,113,148,122,136,154,116,172,0,0
1200 DATA 82,112,137,106,136,97,0,0,63,86
1210 DATA 138,90,142,86,0,0,96,26,168,73
1220 DATA 165,80,173,78,180,66,0,0,214,64
1230 DATA 199,73,226,76,244,81,244,70,312,26
1240 DATA 0,0,256,80,256,88,267,97,269,89
1250 DATA 347,84,0,0,271,96,271,105,328,112
1260 DATA 0,0,266,150,259,132,255,112,265,103
1270 DATA 261,99,250,107,246,104,252,91,247,89
1280 DATA 239,102,231,100,235,86,228,83,225,98
1290 DATA 214,97,214,82,208,82,208,97,199,98
1300 DATA 199,83,193,83,194,97,183,97,178,84
1310 DATA 173,86,176,99,168,102,159,88,155,91
1320 DATA 162,105,168,106,182,102,162,112,156,121
1330 DATA 161,126,175,127,187,122,197,116,205,110
1340 DATA 224,126,238,131,248,133,253,134,257,140
1350 DATA 261,146,263,152,266,151,0,0,217,149
1360 DATA 217,147,220,143,229,142,237,143,242,149
1370 DATA 240,151,236,151,234,149,231,149,234,149
1380 DATA 231,149,228,150,226,149,224,149,224,151
1390 DATA 218,149,0,0,153,211,157,184,160,184
1400 DATA 160,213,153,212,0,0,192,193,202,188
1410 DATA 206,190,210,188,220,193,0,0,192,193,200,197
1420 DATA 212,197
2000 DATA 165,8,74,133,10,164,8,173,48,192,136,234
2010 DATA 234,208,251,165,7,56,229,10,133,7,176,237
2020 DATA 198,6,208,233,96
3000 DATA 162,3,193,1,243,4,193,4,162,4,121,8
3010 DATA 96,3,108,1,121,4,193,4,173,4,162,8
3020 DATA 162,2,162,2,96,6,108,2,121,4,128,8
3030 DATA 144,3,128,1,121,4,121,4,162,4,193,4,243,4
3040 DATA 162,3,193,1,243,4,193,4,162,4,121,8
3050 DATA 96,3,108,1,121,4,193,4,173,4,162,8
3060 DATA 162,2,162,2,96,6,108,2,121,4,128,8
3070 DATA 144,3,128,1,121,4,121,4,162,4,193,4,243,4
3080 DATA 96,3,96,1,96,4,91,4,81,4,81,8
3090 DATA 92,2,96,2,108,4,96,4,91,4,91,8
3100 DATA 91,4,96,6,108,2,121,4,128,8,144,3,128,1
3110 DATA 121,4,193,4,173,4,162,8,162,4
3120 DATA 121,4,121,4,121,2,128,2,144,4,144,4,144,4
3130 DATA 108,2,96,2,91,2,96,2,108,2,121,2,121,4,128,4
3140 DATA 162,2,162,2,121,6,108,2,96,2,91,2,81,8
3150 DATA 121,2,108,2,96,4,91,4,108,4,121,8
```

Atari 400/800, 600/800XL, & 130XE/*Portrait of Liberty*

```
10 DIM S$(6000),S1$(6000)
20 GRAPHICS 8+16:SETCOLOR 2,11,15:SETCOLOR 1,0,0
30 COLOR 1:READ A,B:PLOT A*0.8,B*0.7
40 FOR I=1 TO 216
50 READ C,D
60 IF C=0 THEN READ A,B:PLOT A*0.8,B*0.7:GOTO 90
70 DRAWTO C*0.8,D*0.7
80 A=C:B=D
90 NEXT I
100 X=120:Y=100:GOSUB 3000
110 X=183:Y=102:GOSUB 3000
120 X=173:Y=133:GOSUB 3000
130 DIM V1(102,2),V2(95,2)
140 FOR I=1 TO 102:READ A,B:V1(I,1)=A:V1(I,2)=B:NEXT I
150 FOR I=1 TO 95:READ A,B:V2(I,1)=A:V2(I,2)=B:NEXT I
160 P1=1:P2=1:T1=0:T2=0
170 SOUND 1,V1(P1,1),10,8
180 SOUND 2,V2(P2,1),10,8
190 FOR DE=1 TO 20:NEXT DE
200 T1=T1+1
210 IF T1=V1(P1,2) THEN T1=0:P1=P1+1:SOUND 1,0,0,0
220 T2=T2+1
230 IF T2=V2(P2,2) THEN T2=0:P2=P2+1
240 IF P1<>103 THEN 170
250 GOTO 160
3000 SP=1
3010 LOCATE X,Y,C
3020 IF C=0 THEN 3050
3030 SP=SP-1:IF SP=0 THEN RETURN
3040 GOSUB 4000
3050 PLOT X,Y
3060 LOCATE X,Y-1,C
3070 IF C=0 THEN Q=X:R=Y-1:GOSUB 5000
3080 LOCATE X,Y+1,C
3090 IF C=0 THEN Q=X:R=Y+1:GOSUB 5000
3100 LOCATE X+1,Y,C
3110 IF C=0 THEN Q=X+1:R=Y:GOSUB 5000
3120 LOCATE X-1,Y,C
```

KEYS TO TYPING IN PROGRAMS

Before typing in a program . . .

1. Check to see if it will run on your computer under a version of BASIC you have available (the program heading will tell you what kind of BASIC and what special equipment, if any, the program requires).

2. If you have a disk drive, prepare a disk for saving the program once you're finished typing. Your Disk Operating System or disk drive manual will tell you how.

3. Get your version of BASIC fired up and ready. Read the introductory chapters of your BASIC manual carefully.

While typing, keep in mind that . . .

1. BASIC programs consist of "lines," each beginning with a line number (Macintosh BASIC "lines" don't need line numbers), containing letters, numbers, and punctuation marks of various kinds. Each "line" may be composed of several "statements"—instructions that tell the computer to perform various actions—and may continue over several physical lines on the page and/or on your screen.

When typing in a BASIC program, forget considerations of format and get the *content* of what you type to match the *content* of what you see on the printed page. Regardless of how margins may break up a program "line," it hasn't ended until you reach another line number or the end of the program listing. Begin typing with the line number, then continue on, typing every letter, number, space, and punctuation mark in the order it appears, ignoring margins. Where the "line" ends, there will usually be some trailing spaces (which you don't have to type in), followed by the next line number at the left margin of the listing. At this point, all you have to do is press the RETURN or ENTER key to register the "line" in memory, then continue with the next "line."

2. All marks in a program listing—including every letter, number, space, and punctuation mark—*mean* something to your computer. Moreover, even symbols that look very similar to you mean completely different things to the machine. For example, it is important to distinguish between "1" (number one) and "l" (small letter "L"), or "O" (capital letter "O") and "0" (digit zero). Note that zeros are slashed in most program listings to facilitate discrimination.

It's important, therefore, to duplicate every line exactly when typing. Otherwise you can't expect the program to work as it should, or even work at all. Even upper- and lower-case is important on certain computers; the words "PRINT" and "print" may mean completely different things.

3. Each computer has its own commands and keys for program "editing," and your user's manual will tell you how to use them. Besides the editing keys, there are two sure-fire ways of correcting errors in a BASIC program line. If you're just typing along and make a mistake, press the DELETE key (the back arrow key on most systems) to rub out the offending character, and then continue typing. Once you've pressed RETURN or ENTER to register the line, mistakes are a little harder to fix. You must use the editing keys or type the line in again from the beginning (including the line number) and press RETURN or ENTER. The new line will replace the old one with the same line number in your computer's memory. This option is a little more work, but foolproof.

4. Periodically, during the course of a typing session, in between typing sessions, and always before attempting to run any program you've typed in, make sure to save the program on a disk or cassette. Until you do so, there's no permanent record of your work. Saving a program is usually as easy as typing SAVE "filename" (substitute a one-word name of your choice between the quotes), and pressing RETURN or ENTER. Check your manual for more precise instructions. Each computer system has its own quirks, and it's important to get things like program saving right the first time.

After you've finished . . .

1. Just type "RUN" and press RETURN or ENTER. If you've typed everything in correctly, the program should work as described.

2. Of course, it almost never does. Not even for seasoned programmers. Typing in a program and having it run right off the bat qualifies as a small miracle. Usually there are one or more mistakes, major or minor, that have slipped past your careful scrutiny, and are causing your computer to do unexpected things. Not to worry. Now comes what some people consider the most enjoyable part of the programming process: a procedure called "debugging"—finding and eliminating your mistakes. To review portions of your program on the computer screen, use the LIST command as explained in your BASIC manual. If you have a printer, you might find it more convenient to print out what you've typed (check your manual for the appropriate command). Look over each section of the program carefully, preferably with someone else's help. Make sure you haven't dropped a line or a character, miscounted spaces between a pair of quotes, mistaken a comma for a period, mixed up an "O" and a zero, or (most likely) all of the above. When you find a mistake, retype the offending line from the original listing, including the line number, and press RETURN or ENTER as explained above.

Naturally, mistakes tend to occur more frequently in certain areas of a program than in others. Complicated equations are easy to foul up by dropping or mismatching parentheses or math symbols. Data statements—program lines beginning with the usual number, followed by the word "DATA"—are another popular trouble spot. Check them carefully. And, of course, remember to SAVE a copy of the corrected program when you're finished.

Good luck!

```
3130 IF C=0 THEN Q=X-1:R=Y:GOSUB 5000
3140 GOTO 3010
4000 X=ASC(S$(SP))+59:Y=ASC(S1$(SP)):RETURN
5000 S$(SP)=CHR$(Q-59):S1$(SP)=CHR$(R):SP=SP+1:RETURN
6000 DATA 162,3,193,1,243,4,193,4,162,4,121,8,96,3,108
6010 DATA 1,121,4,193,4,173,4,162,8,162,2,162,2,96,6
6020 DATA 108,2,121,4,128,8,144,3,128,1,121,4,121,4
6030 DATA 162,4,193,4,243,4,162,3,193,1,243,4,193,4
6040 DATA 162,4,121,8,96,3,108,1,121,4,193,4,173,4,162
6050 DATA 8,162,2,162,2,96,6,108,2,121,4,128,8,144,3
6060 DATA 128,1,121,4,121,4,162,4,193,4,243,4,96,3,96
6070 DATA 1,96,4,91,4,81,4,81,8,92,2,96,2,108,4,96,4
6080 DATA 91,4,91,8,91,4,96,6,108,2,121,4,128,8,144,3
6090 DATA 128,1,121,4,193,4,173,4,162,8,162,4,243,4
6100 DATA 243,4,243,2,128,2,144,4,144,4,144,4
6110 DATA 108,2,96,2,91,2,96,2,108,2,121,2,121,4,128,4
6120 DATA 162,2,162,2,121,6,108,2,96,2,91,2,81,8,121,2
6130 DATA 108,2,96,4,91,4,108,4,121,8,0,16,144,8,153,3
6140 DATA 153,1,144,4,121,4,121,4,128,8,162,2
6150 DATA 162,2,121,6,128,2,144,4,162,8,162,2,162,2
6160 DATA 121,4,121,4,128,4,121,4,121,4,0,16,144,8,153
6170 DATA 3,153,1,144,4,121,4,121,4,128,8,162,2,162,2
6180 DATA 121,6,128,2,144,4,162,8,162,2,162,2,121,4
6190 DATA 121,4,128,4,121,4,121,4,0,16,243,4,193,4,173
```

```
6200 DATA 4,162,8,0,4,162,4,144,4,128,4,121,6,128,2
6210 DATA 144,2,173,2,162,8,182,3,162,1,193,4,144,4
6220 DATA 108,4,81,2,72,2,81,2,91,2,96,2,108,2,121,4
6230 DATA 121,4,96,2,121,2,91,4,96,4,114,4,108,2,144,2
6240 DATA 217,2,193,2,182,2,217,2,162,4,162,4,162,2
6250 DATA 162,2,121,6,128,2,121,2,108,2,96,8,91,2,108
6260 DATA 2,121,4,108,4,128,4,243,8
```

Commodore 64 & 128 (C 64 mode)/*Portrait of Liberty*

```
10 MA=8192:SC=1024:PRINT CHR$(147)
20 FOR I=0 TO 20:READ J:POKE 49152+I,J:NEXT I
30 POKE 251,0:POKE 252,32:POKE 53272,PEEK(53272) OR 8
40 POKE 53265,PEEK(53265) OR 32:SYS 49152
50 FOR I=SC TO SC+999:POKE I,22:NEXT I:POKE 53280,2
60 READ A,B:X=A:Y=B:GOSUB 3000:FOR I=1 TO 216:READ C,D
70 IF C=0 THEN READ A,B:X=A:Y=B:GOSUB 3000:GOTO 160
80 X=A:Y=B:GOSUB 3000
90 F=0:V1=ABS(C-A):V2=ABS(D-B):S1=SGN(C-A):S2=SGN(D-B)
100 IF X=C AND Y=D THEN 150
110 F1=F+V1:F2=F-V2
120 IF ABS(F1)>=ABS(F2) THEN F=F2:X=X+S1:GOTO 140
130 F=F1:Y=Y+S2
140 GOSUB 3000:GOTO 100
150 A=C:B=D
160 NEXT I
170 DIM V1%(102,3):S=54272
180 FOR I=0 TO 24:POKE S+I,0:NEXT I
190 POKE S+5,28:POKE S+6,192
200 POKE S+24,15:X1=S+4:FOR I=1 TO 102
210 READ V1%(I,1),V1%(I,2),V1%(I,3):NEXT I
220 P1=1:T1=0
230 POKE S+1,V1%(P1,1):POKE S,V1%(P1,2)
240 POKE X1,33
250 FOR D=1 TO 35:NEXT D:T1=T1+1
260 IF T1=V1%(P1,3) THEN T1=0:P1=P1+1:POKE X1,32
270 IF P1=103 THEN 220
280 GOTO 230
```

```
980 DATA 169,0,170,168,145,251,200,240,2,208,249
990 DATA 230,252,232,224,32,240,2,208,240,96
3000 RO=INT(Y*0.7/8):CH=INT(X*0.8/8):LI=Y*0.7 AND 7
3010 BI=7-(X*0.8 AND 7):BY=MA+RO*320+CH*8+LI
3020 POKE BY,PEEK(BY) OR 2^BI:RETURN
4000 DATA 12,143,3,10,143,1,8,97,4,10,143,4
4010 DATA 12,143,4,16,195,8,21,31,3,18,209,1
4020 DATA 16,195,4,10,143,4,11,218,4,12,143
4030 DATA 8,12,143,2,12,143,2,21,31,6,18,209
4040 DATA 2,16,195,4,15,210,8,14,24,3,15,210
4050 DATA 1,16,195,4,16,195,4,12,143,4,10
4060 DATA 143,4,8,97,4,12,143,3,10,143,1,8
4070 DATA 97,4,10,143,4,12,143,4,16,195,8,21
4080 DATA 31,3,18,209,1,16,195,4,10,143,4,11
4090 DATA 218,4,12,143,8,12,143,2,12,143,2
4100 DATA 21,31,6,18,209,2,16,195,4,15,210
4110 DATA 8,14,24,3,15,210,1,16,195,4,16,195
4120 DATA 4,12,143,4,10,143,4,8,97,4,21,31
4130 DATA 3,21,31,1,21,31,4,22,96,4,25,30,4
4140 DATA 25,30,8,22,96,2,21,31,2,18,209,4,21,31
4150 DATA 4,22,96,4,22,96,8,22,96,4,21,31,6
4160 DATA 18,209,2,16,195,4,15,210,8,14,24
4170 DATA 3,15,210,1,16,195,4,10,143,4,11
4180 DATA 218,4,12,143,8,12,143,4,16,195,4,16
4190 DATA 195,4,16,195,2,15,210,2,14,24,4,14,24
4200 DATA 4,14,24,4,18,209,2,21,31,2,22,96
4210 DATA 2,21,31,2,18,209,2,16,195,2,16,195
4220 DATA 4,15,210,4,12,143,2,12,143,2,16
4230 DATA 195,6,18,209,2,21,31,2,22,96,2,25
4240 DATA 30,8,16,195,2,18,209,2,21,31,4,22
4250 DATA 96,4,18,209,4,16,195,8
```

IBM PC & compatibles/*Portrait of Liberty*

This program has been tested and found to work on the following computers and hardware configurations, using the BASICs shown: IBM PC w/Color/Graphics Monitor Adapter, w/Advanced BASIC A2.00. The Monochrome/Printer card is sufficient if only the music portion of the program is typed in.

```
10 SCREEN 1:KEY OFF:CLS:COLOR 7,0
20 READ A,B:FOR I=1 TO 216
```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CIRCLE READER SERVICE 43

```
30 READ C,D:IF C=0 THEN READ A,B:GOTO 60
40 LINE(A*.8,B*.7)-(C*.8,D*.7),1
50 A=C:B=D
60 NEXT I
70 PAINT(120,100),1
80 PAINT(183,102),1
90 PAINT(173,133),1
100 DIM A$(15)
110 FOR I=1 TO 15:READ A$(I):NEXT I
120 FOR I=1 TO 15
130 PLAY A$(I)
140 NEXT I:GOTO 120
2000 DATA t230l4o2g.e8l2ceg>l1c
2010 DATA l4e.d8l2c<ef#l1g
2020 DATA l4ggl2>e.d4c<l1b
2030 DATA l4a.b8>l2cc<gec
2040 DATA l4o2g.e8l2ceg>l1c
2050 DATA l4e.d8l2c<ef#l1g
2060 DATA l4ggl2>e.d4c<l1b
2070 DATA l4a.b8>l2cc<gec
2080 DATA l4>e.e8l2efgl1g
2090 DATA l4fel2defl1f
2100 DATA l2fe.d4c<b1l4a.b8
2110 DATA >l2c<ef#l1gl2g
2120 DATA >ccl4c<bl2aaa>l4defedcl2c<b
2130 DATA l4ggl2>c.l4defl1g
2140 DATA l4cdl2efdl1c
```

IBM PC*jr* & compatibles/*Portrait of Liberty*

This program has been tested and found to work on the following computers and hardware configurations, using the BASICs shown: IBM PCjr w/Cartridge BASIC J1.00, Tandy 1000 w/GW-BASIC 2.02 version 00.05.00 or 01.01.00.

```
10 SCREEN 1,0:KEY OFF:CLS:COLOR 7,0
20 READ A,B:FOR I=1 TO 216
30 READ C,D:IF C=0 THEN READ A,B:GOTO 60
40 LINE(A*.8,B*.7)-(C*.8,D*.7),1
50 A=C:B=D
60 NEXT I
70 PAINT(120,100),1
80 PAINT(183,102),1
90 PAINT(173,133),1
100 SOUND ON:BEEP OFF
110 DIM A$(15),B$(15),C$(15)
120 FOR I=1 TO 15:READ A$(I):NEXT I
130 FOR I=1 TO 15:READ B$(I):NEXT I
140 FOR I=1 TO 15:READ C$(I):NEXT I
150 FOR I=1 TO 15
160 PLAY A$(I),B$(I),C$(I)
170 IF PLAY(N)>5 THEN 170
180 NEXT I:GOTO 150
2000 DATA t230l4o2g.e8l2ceg>l1c
2010 DATA l4e.d8l2c<ef#l1g
2020 DATA l4ggl2>e.d4c<l1b
2030 DATA l4a.b8>l2cc<gec
2040 DATA l4o2g.e8l2ceg>l1c
2050 DATA l4e.d8l2c<ef#l1g
2060 DATA l4ggl2>e.d4c<l1b
2070 DATA l4a.b8>l2cc<gec
2080 DATA l4>e.e8l2efgl1g
2090 DATA l4fel2defl1f
2100 DATA l2fe.d4c<b1l4a.b8
2110 DATA >l2c<ef#l1gl2g
2120 DATA >ccl4c<bl2aaa>l4defedcl2c<b
2130 DATA l4ggl2>c.l4defl1g
2140 DATA l4cdl2efdl1c
3000 DATA t230o2p1p1l1a
3010 DATA l4<g#.g#8l2a>ccl1<b
3020 DATA l4ggl2>c.<b4al1g
3030 DATA l4ggl2>cc<b>cc
3040 DATA o2p1p1l1a
3050 DATA l4<g#.g#8l2a>ccl1<b
3060 DATA l4ggl2>c.<b4al1g
3070 DATA l4ggl2>cc<b>cc
3080 DATA <p1p1l2ce
3090 DATA f#l1gp2l2ga
3100 DATA b>c.l4<baf#l1gl4f.g8
```


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CIRCLE READER SERVICE 15

```
3110 DATA l2eadl4gagfed
3120 DATA l2ccl4ecl2ffc#l4d<a>defdl2gg
3130 DATA l4ggl2c.l4<b>cdl1e
3140 DATA l4fdl2cd<b>l1c
4000 DATA t230o2p1l2c<bl1a
4010 DATA l4<b.b8>l2>c<a>dl1d
4020 DATA l4ggl2>c.<l4gef#l1g
4030 DATA l4f.g8l2eefec
4040 DATA o2p1l2c<bl1a
4050 DATA l4<b.b8>l2>c<a>dl1d
4060 DATA l4ggl2>c.<l4gef#l1g
4070 DATA l4f.g8l2eefec
4080 DATA l4c.c8l2cdel1e
4090 DATA l4dc<l2b>cdl1d
4100 DATA l2dc.l4gef#g1l4f.d8
4110 DATA l2eddl1gl2g
4120 DATA eel4gel2ffel4agagaal2gg
4130 DATA l4gfl2e.l4dcdl1e
4140 DATA l4ag#l2gagl1e
```

Tandy Color Computer w/Extended Color BASIC/*Portrait of Liberty*

```
10 PMODE 4:SCREEN 1,0:PCLS
20 READ A,B
30 FOR I=1 TO 216
40 READ C,D:IF C=0 THEN READ A,B:GOTO 70
50 LINE(A*.8-30,B*.7)-(C*.8-30,D*.7),PSET
60 A=C:B=D
70 NEXT I
80 PAINT(90,100)
90 PAINT(153,102)
100 PAINT(143,133)
110 DIM A$(15)
120 FOR I=1 TO 15:READ A$(I):NEXT I
130 FOR I=1 TO 15
140 PLAY A$(I)
150 NEXT I:GOTO 130
2000 DATA T5L302GL8EL2CEG03L1C
2010 DATA L3EL8DL2C02EF#L1G
2020 DATA L4GGL103EL4DC02L1B
2030 DATA L3AL8B03L2CC02GEC
2040 DATA L302GL8EL2CEG03L1C
2050 DATA L3EL8DL2C02EF#L1G
2060 DATA L4GGL103EL4DC02L1B
2070 DATA L3AL8B03L2CC02GEC
2080 DATA L303EL8EL2EFGL1G
2090 DATA L4FEL2DEFL1F
2100 DATA L2FL1EL4DC02L1BL3AL8B
2110 DATA 03L2C02EF#L1GL2G
2120 DATA 03CCL4C02BL2AAA03L4DEFEDCL2C02B
2130 DATA L4GGL203CL4CDEFL1G
2140 DATA L4CDL2EFDL1C
```

Tandy Models III & 4 (Model III mode)/*Portrait of Liberty*

Note to Tandy Models III & 4 (Model III mode) owners: Since these models have no sound capabilities, we can only offer the graphic portion of Portrait of Liberty. *To see the portrait, enter the lines below, as well as the data lines at the end of this section.*

```
10 CLS:READ A,B
20 FOR I=1 TO 216
30 READ C,D:IF C=0 THEN READ A,B:GOTO 140
40 X=INT(A*.4)-20:Y=INT(B*.2)-4
50 X1=INT(C*.4)-20:Y1=INT(D*.2)-4
60 SET(X,Y)
70 F=0:XV=SGN(X1-X):YV=SGN(Y1-Y)
80 XQ=ABS(X1-X):YQ=ABS(Y1-Y)
90 IF X=X1 AND Y=Y1 THEN 130
100 F1=F+XQ:F2=F-YQ
110 IF ABS(F1)>=ABS(F2) THEN F=F2:X=X+XV
ELSE F=F1:Y=Y+YV
120 SET(X,Y):GOTO 90
130 A=C:B=D
140 NEXT I
150 GOTO 150
```

Graphics Data/*Portrait of Liberty*

```
1000 DATA 116,172,138,205,151,244,194,253,210,249
1010 DATA 230,218,239,199,228,209,221,212,200,213
1020 DATA 186,207,173,193,165,169,165,155,174,155
1030 DATA 176,151,184,151,184,149,187,148,188,151
1040 DATA 191,151,191,149,194,149,199,155,199,164
1050 DATA 194,178,197,182,205,184,208,184,219,181
1060 DATA 216,178,212,178,210,179,206,178,203,179
1070 DATA 203,165,204,148,200,142,193,141,176,141
1080 DATA 168,144,166,140,175,132,184,130,204,118
1090 DATA 215,127,239,135,245,139,253,153,254,160
1100 DATA 260,166,263,166,264,168,263,170,260,170
1110 DATA 257,174,252,180,251,185,247,189,253,202
1120 DATA 247,236,253,235,253,250,262,255,300,255
1130 DATA 290,232,292,228,288,226,281,191,279,182
1140 DATA 268,158,273,153,263,134,263,120,266,113
1150 DATA 328,112,272,99,272,96,349,85,266,85
1160 DATA 255,78,313,25,233,67,215,64,204,21
1170 DATA 194,65,174,67,94,26,153,76,152,78
1180 DATA 142,85,59,85,136,96,136,99,78,113
1190 DATA 141,113,148,122,136,154,116,172,0,0
1200 DATA 82,112,137,106,136,97,0,0,63,86
1210 DATA 138,90,142,86,0,0,96,26,168,73
1220 DATA 165,80,173,78,180,66,0,0,214,64
1230 DATA 199,73,226,76,244,81,244,70,312,26
1240 DATA 0,0,256,80,256,88,267,97,269,89
1250 DATA 347,84,0,0,271,96,271,105,328,112
1260 DATA 0,0,266,150,259,132,255,112,265,103
1270 DATA 261,99,250,107,246,104,252,91,247,89
1280 DATA 239,102,231,100,235,86,228,83,225,98
1290 DATA 214,97,214,82,208,82,208,97,199,98
1300 DATA 199,83,193,83,194,97,183,97,178,84
1310 DATA 173,86,176,99,168,102,159,88,155,91
1320 DATA 162,105,168,106,182,102,162,112,156,121
1330 DATA 161,126,175,127,187,122,197,116,205,110
1340 DATA 224,126,238,131,248,133,253,134,257,140
1350 DATA 261,146,263,152,266,151,0,0,217,149
1360 DATA 217,147,220,143,229,142,237,143,242,149
1370 DATA 240,151,236,151,234,149,231,149,234,149
1380 DATA 231,149,228,150,226,149,224,149,224,151
1390 DATA 218,149,0,0,153,211,157,184,160,184
1400 DATA 160,213,153,212,0,0,188,191,190,191
1410 DATA 201,187,205,187,211,189,212,187,219,188
1420 DATA 227,192,219,192,214,191,211,192,207,192
1430 DATA 205,191,199,191,197,193,199,196,215,197
1440 DATA 210,200,207,200,203,199,199,200,194,196
1450 DATA 189,192,189,191
```